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Armor in Medieval Europe and its
Relation to Contemporary Weapons
Development

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Clad in Steel: The Evolution of Plate Armor in Medieval Europe and its Relation to Contemporary Arms Development

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History 400

Professor Douglas Sackman

When thinking of the Middle Ages, one of the first things that comes to mind for many is the image of the knight clad head to toe in a suit of gleaming steel plate. Indeed, the legendary plate armor worn by knights has become largely inseparable from their image and has inspired many tales throughout the centuries. But this armor was not always worn, and in fact for most of the years during which knights were a dominant force on battlefields plate was a rare sight. And no wonder, for the skill and resources which went into producing such magnificent suits of armor are difficult to comprehend. That said, it is only rarely throughout history that soldiers have gone into battle without any sort of armor, for in the chaotic environment of battle such equipment was often all that stood between a soldier and death. Thus, the history of both armor and weapons is essential to a fuller understanding of the history of war.

In light of this importance, it is remarkable how little work has been done on charting the history of soldiers' equipment in the Middle Ages. While there have been chapters and articles written on both armor and weapons, such as John Clements' invaluable article "Medieval Armor: Plated Perfection," and one can easily trace the developmental path of both through these, rarely is the impetus for this development ever mentioned. After all, the evolution of armor from scale and chain to plate was a gradual process, and undoubtedly a very complex one. Moreover, such a shift as that from mail to plate armor was demanding in both the skill and resources required. As such, why would armorers bother to change unless there was demand for it? And why would warriors demand change in armor styles and patterns which had served them well for centuries unless they were no longer effective? An obvious answer is that mail armor was no longer effective against the type of weapons employed against it. This lack of effectiveness becomes apparent when one considers the weakness of mail against the penetrative capabilities of arrows

and bolts, and that by the 12th and 13th centuries these weapons were becoming increasingly common throughout Europe. With this in mind, it is clear that the rising proliferation of bows and crossbows on medieval battlefields played a large role in stimulating the shift away from mail. But when plate began to appear on the battlefield, melee weapon designs raced to catch up, and this interplay between offensive and defensive technology eventually resulted in the legendary plate of the late Middle Ages. Indeed, many of the aspects of late medieval plate armor, such as the angled visor and the bevor, can be seen to cover the weaknesses of earlier armor models, thereby making them less vulnerable to contemporary weapon designs, just as weapon designs clearly adapted in ways suited to counter the strengths of armor.

When examining this gradual development of both armor and weapons, it is useful to take at least a brief look at their pre-medieval incarnations in order to understand the origins of medieval designs. From there, the Bayeux Tapestry provides an excellent starting point for a study. The Tapestry's detailed images of 11th century armor and weapons supply an excellent example of the state and effectiveness of military technology at the time, as well as a platform from which to examine their weaknesses. The actual development of plate proceeds naturally from this point, as in turn do the revolutionary new weapon designs. All of this, of course, concludes with the final appearance of the masterwork plate of the 16th century, and its subsequent disappearance due to firearms.

Armor, it must be understood, was not a medieval invention, nor did plate armor develop out of nowhere. The tradition of armor production dated back thousands of years. In fact, there is some evidence of simple forms of armor being worn by prehistoric men when they fought.¹

¹ Kelly DeVries, *Medieval Military Technology* (Ontario: Broadview Press, 1992), 50.

There is also concrete textual evidence of sophisticated armor designs in use by the Greeks as early as the 12th or 13th century BC in Homer's *Iliad*, with the description of Agamemnon's armor "made of parallel strips, ten of dark blue enamel, twelve of gold, and twenty of tin."² Plate helmets had come into use certainly by the fourth century BC and were common throughout the Mediterranean [Figure 1]. The helmet shown, designed in the South Italian-Corinthian type, is made of bronze and appears to be constructed of a single piece of metal. The rounded shape of the helmet would have helped to deflect blows from slashing weapons, and the cheek plates and nose guard, often referred to as a *nasel*, should have protected much of the face from spear thrusts, which were common given that weapon's proliferation in the ancient world.³

Body armor was also fairly developed in the ancient world, as both Greeks and Romans had early forms of plate at their disposal. Early bronze plate can in fact be found dating from the 15th century BC, in the case of the Dendra Panoply. Ancient plate became significantly more advanced under the Romans, however, with the use of their famous *lorica laminata*. This armor, made from interlocking bronze, iron, or even mild steel bands, was in use by the Roman Legions in the first century AD [Figure 2] and would have provided both impressive protection and mobility⁴. However, by the fourth century this sophisticated and expensive armor had largely disappeared and was replaced primarily by cheaper mail designs.⁵ Plate was not to be seen again for many centuries.

It is important to acknowledge that the presence of any type of armor did not result purely from a need for it. It goes without saying that any king or general would want his troops to be

² Homer, *Iliad*, 197-198, in Kelly DeVries, *Medieval Military Technology* (Ontario: Broadview Press, 1992), 51.

³ DeVries, *Technology*, 9.

⁴ DeVries, *Technology*, 53.

⁵ DeVries, *Technology*, 54.

outfitted as well as they could possibly be, as the better equipped soldiers are, the more effective they generally are in battle. Unfortunately, practical considerations often prevent equipping soldiers thus. A key factor in the appearance of plate armor was the infrastructural sophistication needed to produce it. The Romans, and many of the Greek kingdoms and city-states before them, had extremely sophisticated infrastructures. They had long-distance maritime and overland trade, paved roads, monumental architecture, extensive plumbing and irrigation systems, and in the case of the Romans, even running water. This sophistication, and the resulting demand for specialization, would have allowed for the presence of smiths and metallurgists with the skills and time to produce advanced sets of armor such as the Roman *laminata*. With the collapse of Imperial authority in the West and the resulting decreases in population—especially urban—much of this infrastructure was lost, which likely had a major influence on the sophistication of armor designs in Western Europe.

After the collapse of the Western Roman Empire, armor seems to have become rather scarce in western Europe. Not only do we not have any extant examples of mail from that period—something unsurprising, considering the stresses such armor would be subjected to—but contemporary legal codes only make mail hauberks a requirement for the wealthy.⁶ Only in the Carolingian period, beginning in the late 8th century, did quality armor truly proliferate. Indeed, by 805 Charlemagne required every capable male who owned sufficient property to have his own armor and to serve as a horseman in his army.⁷ This resulted in a well-equipped class of heavy cavalry. All of these soldiers would have worn a garment called a *byrnie*, which would have covered much of the body, including the upper arms and legs, and would have at least

⁶ DeVries, *Technology*, 58.

⁷ Simon Coupland, “Carolingian Arms and Armor in the Ninth Century,” *Warfare in the Dark Ages*, ed. John France and Kelly DeVries (Burlington: Ashgate, 2008), 38-39.

incorporated mail.⁸ Various types of solid metal helms would have been worn by cavalry, including the *spangenhelm* [Figure 3].

The success of Charlemagne's armies spoke to the effectiveness of their equipment policies, and these policies were rapidly adopted by foreign nations.⁹ In fact, so rapidly did these policies spread that armor similar to Carolingian models could be seen throughout Europe in the hands of everyone from Spaniards to Vikings, and it is largely at this point that armor remained until the 11th century.

It is unfortunate that no known examples of mail armor survive from the 11th century. Mail, by its very nature, is less solid and resilient than plate and so does not hold up nearly as well to the stresses of time. Add this to the fact that mail armor was often repurposed and reused until it was no longer serviceable and it is not surprising that we are so lacking in examples. With this in mind, the best place to start an examination of central-medieval armor is with the Bayeux Tapestry. The tapestry is made of linen and stitched in worsted, and it depicts the events for two years leading up to the Battle of Hastings in the Norman conquest of Anglo-Saxon England, including the battle itself in 1066. Likely created within ten years of Hastings, the Tapestry is an unequalled source for examining the equipment used at the time of the Norman conquest.¹⁰ While the Tapestry is admittedly somewhat lacking in the precise detail desirable for evaluating the war gear of 11th century soldiers, it nonetheless provides a faithful and consistent—if somewhat simple—rendition of the weapons and armor in use. And while it is extremely unlikely that the seamstresses who stitched it were in any way present at the battle, they

⁸ Coupland, "Arms and Armor," 40.

⁹ DeVries, *Technology*, 62.

¹⁰"The Bayeux Tapestry," *The Bayeux Tapestry: A Guide*.

undoubtedly had contact with those who were, and would have encountered soldiers equipped in similar fashion at some point in their lives.

At any rate, the Bayeux Tapestry depicts several scenes which feature warriors in mail, but the Battle of Hastings is a particularly valuable scene due to the appearance of large numbers of both mounted and unmounted soldiers. Both Norman and Anglo-Saxons wear mail hauberks with forearm-length sleeves as well as leggings.¹¹ The warriors also wear a softer material, possibly leather or some sort of cloth, on their lower legs below the mail leggings, and their hands appear to be bare. Such armor would have provided respectable protection for the warriors wearing it, both infantry and knights, as the entirety of the torso and the majority of both the arms and the legs would be covered. Additionally, Duke William and several other Norman elites are shown wearing mail chausses which cover their lower legs as well, although this feature appears to be quite rare [Figure 4].

The mail leggings are of particular note because of the essential nature of protection for the groin and inside leg, which if struck would lead a warrior to bleed to death rapidly. As such, leggings were included in hauberks as a matter of course, as can be seen by the fact that every mail-clad soldier on the tapestry wears them. In spite of their defensive utility, mail leggings would have been immeasurably problematic for mounted warriors on account of their being both extremely uncomfortable to wear while mounted and very damaging to saddles.¹² Fortunately, Ian Pierce addresses this problem with the suggestion that knights solved this problem by wearing hauberks with knee-length skirts split both fore and aft, which can be seen in Figure 4.¹³

¹¹ Ibid.

¹² Ian Pierce, "Arms, Armour and Warfare in the Eleventh Century," *Medieval Warfare 1000-1300*, ed. John France (Hampshire: Ashgate Publishing Ltd, 2006), 64.

¹³ Pierce, "Arms", 64.

The skirted hauberk would have been both easier to mount in and more comfortable, without significantly reducing protection for a mounted warrior. Pierce states that when mounted, the skirts rest in such a way that they give the impression of leggings being worn, which would account for the fact that all the warriors depicted in the tapestry appear to be wearing leggings, even the mounted ones.¹⁴

The heads of the warriors shown in the Bayeux Tapestry are also protected, almost universally by coifs of mail. The coifs portrayed in the tapestry appear to be a component of the hauberk, although it was not unheard of for a coif to be a separate piece. The coif was an essential part of a warrior's armor as it protected both the head and the neck, making decapitating blows more difficult to achieve, and it could easily deflect glancing blows to the head. However, the flexible nature of mail made it largely ineffective against percussive weapons such as maces, leaving a warrior's head highly susceptible to blunt trauma. For this reason, as well as for the added protection conferred, most knights and many foot soldiers chose to wear helmets over their coifs.¹⁵ The helmets shown on the Bayeux tapestry are of a conical design, sometimes referred to as a nasal due to the metal bar extending down over the face and covering the nose.¹⁶ Some examples of this type of helmet include an extension in the back, possibly as a sort of neck-guard.¹⁷ This sort of helmet had been in service for centuries, popular throughout barbarian Europe and even seeing service in the late Roman army. An example of this type of helm, specifically the helmet of St. Wenceslas, can be seen in Figure 5.

¹⁴ Pierce, "Arms", 64.

¹⁵ Pierce, "Arms," 64.

¹⁶ Pierce, "Arms," 67.

¹⁷ Pierce, "Arms," 67.

Nasal helmets were of a simple but generally effective design, with the rounded conical shape of the helmet serving to easily deflect either downward or horizontal sword blows and the nasal protecting much of the upper face.¹⁸ Considering the popularity of swords evidenced on the Bayeux tapestry, this was a wise investment. Indeed, it stands to reason that a main cause for the nasal helmet's long-term popularity was its effectiveness, as well as its relatively simple design which allowed for it to be manufactured in large numbers without great difficulty. The open design also allowed for excellent visibility even as the nasal protected much of the face from slashing blows. In fact, the basic design of the nasal helmet, with some notable changes, remained in service among infantry into the late Middle Ages. However, the open nature of the helmet's face made it highly vulnerable to thrusts from spears, swords or daggers and provided little protection against missile weapons. It would also be a mistake to assume that such helmets were infallible, as William of Poitiers reports that "Shields, helmets, hauberks were cut by [Duke William's] furious and flashing blade."¹⁹

Speaking of weapons, the Bayeux Tapestry also provides excellent insight into the weapons used by 11th century armies. By far the most common weapons seen on the Tapestry are the axe, spear, and sword. While shortbows do appear, there are only six of them shown on the Tapestry proper, with one of these being a lightly-clad horse archer.

Axes are common in both one and two-handed variants, with the smaller one-handed weapons often serving as throwing axes. Popular for centuries due to its remarkable power, the axe was popular in England at least by time of the Vikings, but became extremely popular with

¹⁸ Pierce, "Arms," 69.

¹⁹ William of Poitiers, *Deeds of William, Duke of Normans and King of the English*, excerpted in John Simkin, *Spartacus Educational: Battle of Hastings* (2016), <http://spartacus-educational.com/NORhastings.htm#source>.

the Anglo-Saxon army.²⁰ The axe delivered impressive power when swung and, with the heavy head weighing between 300 and 900 grams, was able to easily smash through both shields and armor, likely accounting for its popularity with the Anglo-Saxon army at Hastings.²¹ Such axes can be seen in the hands of a number of the Anglo-Saxon huscarls depicted on the tapestry, who are often shown swinging them at the mounted Norman knights [Figure 6]. Indeed, the axe remained popular as an infantry weapon through the thirteenth century, although the warrior wielding it was admittedly highly vulnerable when raising it to swing.

Lances and spears, both common on the Bayeux Tapestry, were similar in design. In fact, the lance was essentially a cavalry spear and was largely used in the same way for centuries, namely for thrusting at close range.²² The infantry spear was used for much the same purpose, being of simple design and conferring better reach than a sword or axe. This basic design and function had been largely unchanged for millennia, with spears being used as commonly by ancient armies as by medieval ones. The greatest difference between spears and lances, at least at this point, was the length. Cavalry lances tended to be slightly longer, ranging from nine to eleven feet in length.²³ As the tactic of “shock combat” developed, lances would shift both in their design and the way they were used, but in the late 11th century they seem to have been used largely in a similar manner to infantry spears. The spear and lance-heads were often leaf-shaped, which allowed them to be used effectively for both cutting and thrusting, and it is in the latter function that they were most dangerous to mail-clad troops.²⁴

²⁰ DeVries, *Technology*, 17.

²¹ DeVries, *Technology*, 16.

²² DeVries, *Technology*, 12.

²³ Pierce, “Arms,” 70.

²⁴ Pierce, “Arms,” 70.

Swords, of course, were among the most common medieval weapons. They had been extremely popular for centuries, being common in both the Roman Army and the barbarian forces which invaded Europe, and they remained common at the time of the Norman Conquest. Figure 7 shows two Norman knights wielding swords against Anglo-Saxon huscarls, and a broken sword can be seen in the lower border. It is worth noting that one of these knights is slashing at the neck of his enemy, likely hoping for a decapitating blow, while the other raises his sword to strike. This clearly demonstrates the intent behind this weapon's use, as contemporary longswords were designed largely for slashing, a trait which can be found in their construction. Figure 8 shows a tenth-century blade, the type of which would likely have been seen at Hastings. The sword is clearly broad and flat-bladed, being of a uniform width until it tapers to a point at the tip. This design creates a heavy blade capable of delivering a large amount of force from anywhere along its edge, making it ideal for slashing at a target. Figure 9 shows a 12th or early 13th century sword of similar design. Such swords, used well, could prove remarkably effective, for it is described by William of Poitiers how at Hastings "breaches were cut in several places [in the English line] by the swords of the Norman knights,"²⁵ and many of the English troops holding that line would have been equipped with mail armor. That said, mail was far from useless and could under the proper circumstances provide good protection.

Ian Pierce describes in great detail the defensive properties of mail, explaining how "the protection which mail offers depends upon the force of a blow being distributed over a large area. Thus the blow is significantly absorbed by the mail."²⁶ The necessary consequences of this are that while areas such as the chest and abdomen are well protected by a large amount of rings,

²⁵ William of Poitiers, *Deeds*.

²⁶ Pierce, "Arms," 66.

more compact places such as the arms, shoulders, neck, and even head do not distribute the force as effectively. This means that a powerfully-delivered slashing attack from a heavy blade to any of these places could easily result in mail being cleaved. Naturally, swords of the time period were designed with this in mind.

Of course, if mail was always easily penetrated, no one would have bothered to wear it. The fact that it was consistently used for so many centuries speaks volumes to its effectiveness. It has already been mentioned how mail could effectively stop slashing blows to the chest or abdomen, and warriors would regularly wear heavily padded garments underneath their hauberks to help absorb the shock of weapon blows, be they from blunt or bladed weapons.²⁷ And while a warrior's arms would have been more vulnerable due to the smaller number of mail rings, one arm would have carried a weapon, which could be used to parry, and the other would usually have been protected by a large shield, greatly reducing the likelihood of its being struck. Their heads would have been protected by conical nasal helms like those shown on the tapestry, or in Figure 5.

In the thirteenth century, however, things began to change. In a rather sudden development, soldiers began to reinforce their mail armor with solid metal plates, which had not been seen on battlefields in any quantity for almost a thousand years. While plates had occasionally appeared as reinforcements prior to this period, the thirteenth century was when plate armor truly began to spread.²⁸ What is particularly interesting about this is why it happened. Why should soldiers suddenly begin upgrading armor that had served them well for

²⁷ Pierce, "Arms," 66.

²⁸ DeVries, *Technology*, 77.

centuries? The answer, of course, is that mail armor was proving increasingly inadequate against the weapons it was required to defend against.

It is true that the first plate reinforcements were not optimal for defending against arrows and quarrels. In fact, plate reinforcements in the early to mid-thirteenth century focused primarily on the knees, shins, and elbows: areas not very heavily exposed to missile fire.²⁹ However, these plates did mitigate some of the weaknesses of mail armor. For example, the shins in particular, being distant from the arms and upper body, were naturally more difficult to cover with a shield and thereby more vulnerable to sword and spear strikes. Covering these locations with plates would have improved the defense against such attacks, thereby responding to some of the weaknesses of the mail hauberk.

In truth, by the mid-thirteenth century the weaknesses of mail armor desperately needed to be addressed. Effective as it had been against bladed weapons, mail was not proving up to the task of dealing with the piercing capacity of bows and crossbows, and these weapons were proliferating rapidly. The Assize of Arms, issued in England in 1187, required all lower-class levies to carry bows, and these weapons had some exceptional properties.³⁰ While the effective range of 12th century English longbows is contested, their ability to penetrate mail is not. Robert Hardy relates one incident from the Welsh wars in which an English soldier “was wounded by an arrow that penetrated his thigh, the casing armor on both sides, the part of the saddle known as the alva, and mortally wounded the horse.”³¹ Longbows could also maintain an impressive rate of fire, in the hands of skilled archers,³² and with the archers firing while standing sideways in

²⁹ Claude Blair, *European Armour* (London: B.T. Bastford Ltd. 1958), 38.

³⁰ Robert Hardy, *Longbow* (London: Bois d’Arc, 1992), 38.

³¹ Hardy, *Longbow*, 36.

³² Hardy, *Longbow*, 43.

close order, “they could send storms of arrows into advancing cavalry, and, as much as anything by galling the horses, turn a charge into a rout. Against light armed infantry they would be devastating.”³³

While the longbow proved very popular in England, on the continent it was the proliferation of the crossbow that truly necessitated improvements in defensive technology. While the crossbow had existed in the Ancient World, it largely faded from use during the early Middle Ages, possibly due to the low technological standard of the barbarian kingdoms. Whatever the reason, by the late 11th century it had returned. While there is evidence that it was used in the First Crusade from 1095-1099, it truly began to spread in the late 12th century.³⁴ By the mid-12th century, it had flourished. The garrison of Saphet in the Holy Land, about the year 1250, included 300 crossbowmen, and the Lombard League in 1231 had one crossbowman for every two horsemen in its armies.³⁵

The crossbow’s effectiveness as a weapon cannot be denied. The Byzantine princess Anna Commena describes its capabilities in the *Alexiad*, asserting that “the missiles...transfix a shield, cut through a heavy iron breastplate and resume their flight on the far side.”³⁶ Clearly, contemporary armor was of little use against the penetrative power of a crossbow, as it could easily pierce even basic plate at close range. With this in mind, it is little wonder that a replacement for traditional mail was sought. Numerous modifications were added to the crossbow over the course of the Middle Ages, such as a stirrup attached to the end of the stock so an arbalester could brace the bow with his foot while reloading and the windlass to increase

³³ Hardy, *Longbow*, 44.

³⁴ Philippe Contamine, *War in the Middle Ages*, trans. Michael Jones (Oxford: TJ Press Limited, 1984), 72.

³⁵ Contamine, *War*, 72.

³⁶ *The Alexiad of Anna Commena*, tr. E.R.A. Sewter, in Phillipe Contamine, *War in the Middle Ages*, trans. Michael Jones (Oxford: TJ Press Limited, 1984), 71.

drawing speed.³⁷ Changes in the composition of the bows, such as the transition to composite crossbows in the early 13th century, further increased their power and thus their effectiveness against armor.³⁸ By the late Middle Ages, crossbows were made largely from steel. While this increased the weight of the bow significantly, it also increased its draw weight and thus its power. Indeed, the power of such crossbows may well account for their wider proliferation than longbows, as “The bolt of a steel crossbow was a heavy and dangerous projectile, even when at the end of its flight; far more so than an arrow. A bolt which did not happen to penetrate armour, must have dealt a blow sufficient to stun a man and knock him to the ground.”³⁹ In light of these developments, it is clear that the power of crossbows was far more than could be handled by contemporary mail armor. Its effectiveness, which so overwhelmed Anna Commena, actually led to the weapon’s being outlawed for use against Christians by the second Lateran Council in 1139,⁴⁰ and even the best armor of the time was of little use against it.

Plated body armor began to evolve around this time, initially in the form of iron plates sewn onto leather armor.⁴¹ While it is difficult to determine the proliferation of this type of armor, due to the fact that it was often worn under a surcoat, it is nonetheless useful for charting the development of plate armor, as several notable figures are recorded wearing it, including Richard I of England. Interestingly, even with this rudimentary form of plate armor, crossbows still proved remarkably effective, as Richard I was himself killed by one.⁴²

³⁷ DeVries, *Technology*, 41.

³⁸ DeVries, *Technology*, 41.

³⁹ Ralph Payne-Gallwey, *The Book of the Crossbow* (Mineola: Dover Publications, 1903), 19.

⁴⁰ Payne-Gallwey, *Crossbow*, 3.

⁴¹ Blair, *Armour*, 38-39.

⁴² Contamine, *War*, 72.

Probably the easiest place to see plate armor development in the 13th century is in head protection, for it was in this period that the great helm appeared. Figure 10 shows an excellent 13th century German example, and even a cursory inspection will show the difference between it and the earlier conical helmets. Perhaps the most important of these is the full faceguard integrated into the design. This feature would have protected the entire face from all types of attacks, including blades, spears, maces and projectiles, with firm plates resistant to both sharp and blunt traumas. The metal ridge running down the front of the visor and bisecting the eye-slit would also have provided some protection against slashing attacks to the face. In fact, the only noticeable defensive weakness of the great helm was the eye-slit, which could be targeted with a precisely aimed dagger, sword, or spear thrust. The fact that the helmet encases the entire head means that it also would have protected the back of the head in addition to making it easy to keep on in battle without necessitating chin straps or other such devices.

There were, however, limitations to plate armor, and these limitations were responsible for its being a phenomenon primarily among cavalry, as opposed to infantry. To start with, plate, especially more advanced forms of plate, required greater skill to forge than did mail. Mail rings would often be either punched out of a sheet of metal, molded, or cut from a length of steel wire. Afterward, the rings would be riveted together or otherwise closed so that each ring linked through four others.⁴³ While this process was time-consuming, the level of skill required was not excessively high, and the armor was variable, being able to fit soldiers of various sizes. Plate, by contrast, was made from various plates of iron or steel molded into particular shapes. Seeing as the shapes required differed based on the particular piece being forged, a wide variety were used

⁴³ Matthias Pfaffenbichler, *Medieval Craftsmen: Armourers* (Toronto: University of Toronto Press, 1992), 57.

in forging a complete set of plate armor. Each plate was made from iron or steel bars hammered into shape, and for more sophisticated designs the plates had to be custom fitted for the men who would wear them in order to reduce chafing and allow for optimal distribution of weight and economy of movement.⁴⁴

The result of this complex and resource-intensive forging process was armor that was significantly more expensive to make than mail. Consequently, only the wealthy could afford it and more often than not, the wealthy fought on horseback. Infantrymen had to make do with lighter, less expensive designs. Not all of plate armor's restrictions were purely economic, however. While a mail hauberk was certainly not light, the additional metal that went into the forging of plate made it especially heavy. True, as plate designs became more sophisticated the weight of the armor became progressively easier to bear, but even the best suits could not be considered light. For infantrymen who were required to march hundreds of miles on campaign, this weight would have been beyond uncomfortable. Finally, as personal experience will attest, the visibility conferred by a great helm is decidedly unimpressive. The added protection such a helm provides comes at the cost of peripheral vision, and for an infantryman locked in the chaotic press of a melee fight, the benefit would likely not have been worth the cost, especially without a coat of plates to protect vulnerable places on his body.

Plate armor truly came into its own during the 14th century, and it is during this period that some of the most dramatic changes in weapon design can be observed. While both longbows and crossbows continued to be popular, with the former especially a phenomenon in England,

⁴⁴ Pfaffenbichler, *Armourers*, 62.

infantry weapons changed drastically during the 14th century. For starters, staff weapons became much more common. Of particular note among staff weapons were poleaxes and halberds.

Figure 11 shows an example of a late 14th century halberd head, and in this several characteristics can be observed. First, it must be remembered that this head would have been mounted on the end of a long wooden haft, gripped with two hands, which would have provided impressive reach. The tip of the halberd head is pointed, allowing it to be used either to keep foes at bay or to thrust at them directly.⁴⁵ The small pick on the back of the head, sometimes curved, could be used to drag mounted soldiers from horseback and the heavy axe-blade on the front to finish them.⁴⁶ The poleaxe was of a similar design, although the axe blade was more compact and thus more useful for penetrating heavy armor and the pick was replaced by a small hammer head, which could be used for smashing through plate⁴⁷. Such weapons as these, with their long hafts and powerful attachments, made the weapons as effective for swinging as they were for thrusting, and allowed a warrior to channel a great deal of force into a blow without sacrificing the spear-like ability to hold enemies, both mounted and unmounted, at bay. Indeed, staff weapons were often used as effectively against infantry as they were against cavalry, for the power they conferred proved invaluable against the increasingly common armored foes of the late medieval world.

A major reason why power and reach were so important in new weapon designs is because older spears and swords were lacking in one or the other. The spears portrayed in the Bayeux Tapestry, as seen in Figure 6, were narrow and fairly light. Longer than swords or axes, they provided excellent reach in the press of melee, but the rather small spearheads would likely

⁴⁵ *Encyclopedia Britannica Online*, ed. Rev. William L. Hosch, 2007.

⁴⁶ *Ibid.*

⁴⁷ Ewart Oakeshott, *A Knight and His Weapons* (Chester Springs: Dufour Editions, 1997), 48-49.

not have been able to deliver sufficient power from a simple thrust to penetrate heavy plate, to say nothing of the danger of a thrust simply glancing off a rounded plate. The picks, blades, and hammers of staff weapons, however, were able to drag a knight from his horse and cleave or smash through his armor with relative ease, which is no doubt why such weapons proliferated as far as they did.⁴⁸

Spear designs also changed, especially in the 14th and 15th centuries, developing into pikes. Pikes were in many ways similar to earlier infantry spears, but were much longer. The intent behind this is fairly clear: longer weapons were more easily braced against charges and thus more likely to hold off an advancing foe, especially a mounted one, as the risks of riding into a metal point at full gallop are rather obvious. Simple as this design may have been, it was undoubtedly effective, as the Flemish army proved against the French at the battle of Courtrai in 1302. At this battle, a large force of French cavalry charged a force of Flemish infantry who were braced in close order and equipped with a number of hafted weapons, including pikes, behind a network of water-filled ditches. The French charge, as Kelly DeVries relates, “was halted...the French horses stopped and the knights were pushed into the ditches behind them.”⁴⁹ Pike designs remained popular and largely unchanged throughout the rest of the Middle Ages and well into the following centuries.

Weapons also had to change for close-quarters fighting in order to deal with the heavier armor that appeared. Maces, for one, became increasingly popular later in the Middle Ages. In particular, a particular design referred to as the “Gothic mace” saw wide usage, due largely to its ability to crush an opponent’s armor.⁵⁰ The Gothic mace weighed an average of 1275 grams and

⁴⁸ Oakeshott, *Weapons*, 51.

⁴⁹ Kelly DeVries, *Infantry Warfare in the Early Fourteenth Century* (Woodbridge: Boydell Press, 1996), 17.

⁵⁰ Oakeshott, *Weapons*, 55.

its head was compact and wrapped in pointed flanges.⁵¹ The weight of the mace, concentrated in the compact head and supplied with ample force, could easily crush plate armor, which would impair a soldier's ability to fight even if he was not directly injured.⁵²

Swords too underwent some significant changes. Figure 12 shows a late-14th or early-15th century longsword from western Europe. The changes in design from 11th and 12th century models are striking. The most notable of these changes is the much more tapered, almost triangular shape of the blade. This shape would allow force to be more effectively channeled along the length of the blade during a thrust, reducing the danger of it flexing or breaking.⁵³ The point of the sword is also much more prominent, illustrating its thrusting purpose. An interesting design detail can be found near the point of the blade. Along its middle, there is a raised portion called a ridge, which is often found in swords optimized for armor penetration. The ridge concentrates the force of a thrust along the spine of a blade, rather than spreading it throughout the surface, allowing it to be directed down the sword's length. This particular trait serves to increase the rigidity of the blade's point, reducing its likelihood of flexing during a critical thrust, without increasing its brittleness and probability of breaking. This rigidity was necessary, as thrusts became the primary method of penetrating armor with a sword, as the thick and rounded plates would easily resist slashing blows.⁵⁴

Daggers were also fairly effective against armored soldiers, and this development was not new. The strength of a dagger lay in its precision, for a weapon so small and easily directed could be used against the vulnerable points in an enemy's armor. Indeed, as John Clements

⁵¹ Oakeshott, *Weapons*, 55.

⁵² Oakeshott, *Weapons*, 55.

⁵³ Oakeshott, *Weapons*, 68.

⁵⁴ DeVries, *Technology*, 24.

relates “Medieval daggers such as the rondel were special weapons quite capable of killing an armored man, especially one who had fallen from or was pinned under a slain horse.⁵⁵”

However, this was not so much due to daggers being able to easily penetrate heavy plate as to precisely strike vulnerable points, such as the eye-slit. This was especially the case when a soldier had been knocked down or otherwise overpowered, for “When a knight was riding against a hedgehog of tightly wielded pole arms and his horse was shot out from under him, he might well end up lying on the ground stunned while hordes of enemies rushed to jab sharp metal spikes into his eyes.⁵⁶”

Of course, as weapons improved, so too did armor. Plate became progressively more sophisticated as the Middle Ages went on, reaching its golden age in the 15th and 16th centuries. Figure 13 shows a restored suit of plate armor from the early 15th century. The legs are well-protected in their entirety, with the shins, knees, and thighs all protected by plates, called greaves, poleyns, and cuisses respectively.⁵⁷ The hands, shoulders, elbows, and outer arms are also all covered by plates, the torso is guarded by a brigandine constructed of plates riveted together inside the leather doublet, and the head is encased in a type of helmet called a “visored bascinet.” The weak points between the plates are all covered by mail. This armor would protect the extremities well against blows of all kinds, as the rounded plates would easily redirect force rather than absorbing it, and the brigandine would protect against slashing or even light piercing blows. However, there are some notable weaknesses in this armor. For one, the inner arms are not plated, leaving them vulnerable to a penetrating attack when the arm is raised to strike. Another, even more dangerous weakness, lies in the relative lack of protection for the neck,

⁵⁵ John Clements, “Medieval Armor: Plated Perfection,” in *Military History* 22 (2005), 39.

⁵⁶ Clements, “Armor,” 39.

⁵⁷ DeVries, *Technology*, 76.

which could be easily severed in such armor as this. In fact, such a fate befell a French knight at the battle of Mons-en-Pevele much earlier in 1304, who was decapitated while helping king Phillip the Fair onto his horse.⁵⁸

The contrast with Figure 14, dated 1548, is striking. Nearly all the weaknesses of the early design have been corrected in this later model. The arms are now completely encased in plating, with even the crooks of the elbows covered by a *coudiere*, which would protect this vulnerable section of the arm. The shoulders are guarded by rounded pauldrons, the gauntlets are entirely metal, and the legs and feet are completely protected. The torso, in contrast with the earlier 14th-century armor, is completely covered by solid, shaped plates which have no apparent vulnerabilities and would deflect slashing blows with ease, even as they resist penetrating attacks. The upper thighs and pelvis are protected by a skirt-like design called a *tuille*, made of segmented plates, which would protect this portion of the body while still allowing the legs an impressive range of movement.

The helmet design is especially interesting. The helmet attached to the 16th century armor is referred to as a “close helm,” and is similar in many ways to the earlier *bascinet* design. They share a rounded cranium and adjustable visor, although the visor on the close helm has a more angled design, likely to assist with deflection of thrusts to the face. The close helm is in fact a remarkably sophisticated design, as it often included an integral neck-guard called a *bevor*, which can be observed in Figure 14. This feature reduced the risk of decapitation, but it also visibly closed under the chin, making custom fitting a requirement. Sometimes the neck was instead protected by a separate piece of armor called a *gorget*, which was in effect a steel collar,

⁵⁸ DeVries, *Infantry Warfare*, 40.

but the choice between one or the other seems to have been largely a matter of personal preference.⁵⁹ The precisely fitted and complex design of the close helm offered unparalleled protection, with the only true weak point being the eye-slit, but also meant that the helmet needed to be opened vertically via integral locks and pivot points in order to be put on. Otherwise, it would not fit over the head. A benefit of this, however, is that there was little to no risk of the helmet being lost during battle.

With so much plating covering a soldier, it comes as no surprise that many believe knights to have been clunky and awkward on the battlefield. This belief does not do credit to the sophistication of late medieval armor designs. A plate harness was not designed solely to provide optimal protection, but also to allow for freedom of movement. Although this seems obvious after some thought—after all, if armor was such an impairment in battle, it wouldn't have been widely worn for hundreds of years—it is nonetheless worth examining in closer detail. To this end, John Clements describes some of the traits of late medieval plate armor in order to verify the agility it provided. While he admits that “specialized armor designed exclusively for mounted fighting or tilting was much heavier and less maneuverable [than that worn by infantry],”⁶⁰ he nevertheless correctly asserts that “a harness was designed to evenly distribute the armor’s weight on the wearer”⁶¹ and as such, the weight of the armor was far from excessively burdensome. He also references accounts of training for armored warriors in the 14th and 15th centuries, pointing out how “warriors in training were advised to keep a wooden horse to practice jumping on and off the saddle as well as becoming accustomed to sitting mounted in armor.”⁶²

⁵⁹ Ewart Oakeshott, *A Knight and His Armor* (Chester Springs: Dufour Editions, 1999), 96.

⁶⁰ Clements, “Armor,” 40.

⁶¹ Clements, “Armor,” 41.

⁶² Clements, “Armor,” 43.

While it goes without saying that jumping into a saddle or climbing over obstacles are feats that would require great agility and thus armor must have provided that agility, it makes perfect sense that maneuverability would be emphasized in armor construction. After all, if a knight's horse were to be shot out from under him, or if he were to be knocked to the ground during a battle, he would need to be able to recover quickly in order to avoid being cut down while he lay incapacitated. Battle is chaotic by nature, and a warrior must always be ready to cope with sudden reversals.

Plate armor was widely used by the wealthy and powerful in the Middle Ages. There are numerous examples of suits belonging to various powerful men. Emperor Frederick II had them, as did Archduke Siegmund of Tyrol, Charles I of Holland, and Henry VIII of England.⁶³ While the visual impressiveness of such armor is impossible to deny, these wealthy elite would not have gone to such lengths to procure incredible sets of defensive equipment if it had not been worth the investment. Unfortunately, masterwork sets of plate armor were so expensive that few but the elite could afford them. While the decoration of the armor was a part of this, one of the most difficult tasks for an armorer was fitting the plates for the armor's wearer. Pfaffenbichler recounts an instance of master armorer Andreas Brenker, making armor for Archduke Ferdinand II, who "wanted to fit the pieces on the Archduke himself before he hardened them"⁶⁴ in order to ensure a proper fit. There were many similar instances, such as master armorer Francesco Missaglia staying at the court of Burgundy for an extended period in order to take measurements from his customer.⁶⁵ With such skill and attention required, it is no wonder that costs for plate

⁶³ Pfaffenbichler, *Armourers*, 67-69.

⁶⁴ Pfaffenbichler, *Armourers*, 66.

⁶⁵ Pfaffenbichler, *Armourers*, 66.

harnesses were high. These costs, however, largely restricted these fine sets of armor to the wealthy elite.

The rate of armor development during the second half of the Middle Ages was unrivalled throughout history. In the space of 500 years, armor went from mail hauberks and iron caps to full-body suits of custom-fitted steel plate. And while the causes for this development were multi-faceted—technological, infrastructural, and political developments no doubt played a significant role—the greatest impetus for improvement was the need for better armor to protect against increasingly lethal weapons. During the 12th and 13th centuries in particular crossbows proliferated on the continent and the longbow came to dominate English warfare. With their remarkable power and range, these weapons were able to easily penetrate the mail armor that had served so well up to that point. But as plate improved, so too did the weapons employed against it, and staff weapons, daggers, and thrusting swords became increasingly common on battlefields. Of course, armor grew progressively better as a result. This medieval arms race finally ended, however, with the advent of firearms. Although it took time for gunpowder weapons to truly come into their own, once they did their power and range eventually rendered even the most advanced armor obsolete.



Figure 1: *Bronze Helmet of South Italian-Corinthian Type*, Metropolitan Museum of Art,
<http://www.metmuseum.org/art/collection/search/257637>.



Figure 2, *Roman Soldier in Lorica Segmentata*, Wikimedia Commons,

<https://commons.wikimedia.org/>



Figure 3, *Helmet (spangenhelm)*, Metropolitan Museum of Art,
<http://www.metmuseum.org/art/collection/search/24685>



Figure 4, *Bayeux Tapestry*, kingsacademy.com



Figure 5, *Helmet of St Wenceslas*, Wikimedia Commons,
https://commons.wikimedia.org/wiki/File:St_Wenceslas_helmet.jpg



Figure 6, *Bayeux Tapestry*, <http://4.bp.blogspot.com/>



Figure 7, *Bayeux Tapestry*, <https://www.bing.com/images/>



Figure 8, *Sword*, The Metropolitan Museum of Art,
<http://www.metmuseum.org/art/collection/search/24832>



Figure 9, *Sword*, The Metropolitan Museum of Art,
<http://www.metmuseum.org/art/collection/search/25601>



Figure 10, *Topfhelm*, Wikimedia Commons,
https://commons.wikimedia.org/wiki/File:Topfhelm_DHM_transparent.png



Figure 11, *Halberd*, The Metropolitan Museum of Art,
<http://www.metmuseum.org/art/collection/search/34293>



Figure 12, *Sword*, The Metropolitan Museum of Art,
<http://www.metmuseum.org/art/collection/search/23367>



Figure 13, *Armor*, The Metropolitan Museum of Art, <http://www.metmuseum.org/art/collection/>



Figure 14, *Armor*, The Metropolitan Museum of Art,
<http://www.metmuseum.org/art/collection/search/>

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